Rapid Deployment Flood Control System

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References Cited

U.S. Patent Documents

422901	Mar., 1890	Arnett	405/114.
848319	Mar., 1907	Phillips	220/62.
1077791	Nov., 1913	Blaauw.	
3191386	Jun., 1965	Wiegel et al.	
3213628	Oct., 1965	Serota.	
3901406	Aug., 1975	Kivett	220/8.
4362433	Dec., 1982	Wagner et al.	
4370075	Jan., 1983	Scales	405/20.
4692060	Sep., 1987	Jackson, III.	
4869617	Sep., 1989	Chiodo	404/6.
4921373	May, 1990	Coffey.	
5040919	Aug., 1991	Hendrix.	
5059065	Oct., 1991	Doolaege.	
5125767	Jun., 1992	Doolaege.	
5154302	Oct., 1992	Alcorn	220/4.
5183180	Feb., 1993	Hawkins et al.	220/669.
5188460	Feb., 1993	Dorse	220/495.
5632573	May, 1997	Baker.	
5645373	Jul., 1997	Jenkins.	

5655679	Aug., 1997	Schutz	220/1.
5673664	Oct., 1997	Lassanske	220/495.
5779391	Jul., 1998	Knight	405/20.
5,993,113	Nov., 1999	Darling	405/114
6,012,872	Jan., 2000	Perry, et al.	405/114
6,485,230	Nov., 2002	Robinson	405/64
6,551,025	Apr., 2003	Dery	405/115
6,637,474	Oct., 2003	Hall	141/231
6,641,329	Nov., 2003	Clement	405/115

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates broadly to methods for preventing or inhibiting the flow of water and other fluids, including oily water or toxic chemicals. In a preferred aspect, the invention relates to flood control systems, and more preferably to mobile flood control systems.

2. Description of the Related Art

Flood control systems may be classified as either stationary or mobile. One common type of stationary flood control system is a fixed, concrete dam. An early effort at improving stationary dams is disclosed in U.S. Pat. No. 1,077,791, disclosing a concrete dam structure having a "honeycomb" construction, with individual cells that may be either empty or filled with water. Another common and relatively inexpensive stationary flood control system is an earthen levee.

One of the disadvantages with stationary flood control systems is the amount of time needed build them. Another disadvantage is the high cost to engineer them. Another disadvantage is the high cost to construct them. Another disadvantage is a tremendous amount land that is required and the destruction of valuable historic and ecological treasures. Another disadvantage is that the dam is fixed in a permanent location and the designed capacity that may be inadequate because the amount and rate runoff is greater than anticipated. Dams are now understood to have and adverse impact upon the environment. Yet this does not negate the fact that a viable means for flood control is needed in place of these systems hence the need for this device.

For mobile flood control, sandbags have been and are still the most well-known and widely used technique. During flooding, sandbags are typically placed by human hands at locations that are still above the rising water level, to collectively create a wall, dam, or

barrier against the floodwaters. Sandbags, however, have a number of logistical problems and disadvantages.

One of the problems with sandbags lies in the amount of human labor required for their installation. Each bag must be filled, usually by hand, and then placed at the location where the barrier is being constructed. Another problem is obtaining and transporting sufficient quantities of sand for filling purposes, which is often very expensive and time-consuming. Another problem is the logistics of coordinating the human effort of filling the bags and placing the bags at the right location within the appropriate time frame.

Several attempts have been tried to improve the use and deployment of sand by employing machines to the fill bags or structural partitions. Even with machinery the use of sand to control flooding is a very daunting and often impossible task due to the sheer number of sandbags that must be placed. When machinery is used the labor must be highly skilled and well trained to avoid injury and death.

Another problem that can make the use of sandbags more difficult is the fact that sandbags must often be placed in pouring rain creating safety hazards. Still another problem is that the placement of the bags must be done in a precise manner otherwise instability will be created. Another problem is that plastic sheeting or netting is often needed to prevent seepage and weakening of the dam. Another problem is that the sandbag dam requires constant monitoring and maintenance to prevent a breakthrough resulting in failure.

Still another problem is that after flooding, once the waters have subsided, the sandbags must be removed, either in a filled condition, or else emptied of their contents at the location.

As a result other approaches have been suggested and tried as a substitute for sandbags. Many of these other approaches rely on water or fluid (instead of sand) placed inside tubes or other structures to provide the weight needed to resist the hydrostatic forces of rising water. Such systems are exemplified in the "Water-Bag Dam or Dike and Method," disclosed in Jackson III, U.S. Pat. No. 4,692,060; in the "Portable Highway Barrier" disclosed by in Chiodo, U.S. Patent 4,869,617: in the "Barrier For Containing Floods," disclosed in Coffey, U.S. Patent 4,921,373; in the "Device for Controlling Flood Waters and/or Hazardous Liquid Spills," disclosed in Hendrix, U.S. Pat. No. 5,040,919; in the "Apparatus and a Method for Joining Water Structure Sections or the Like," disclosed in Doolaege, U.S. Pat. No. 5,059,065; in the "Wall-Like Retainer Segments for Retaining Fluids," disclosed in Baker, U.S. Pat. No. 5,632,5723; and in the "Flood Control System," disclosed in Perry, et. al, U.S. Patent 6,012,872; and in the "Flood Control Barrier," disclosed in Dery, U.S. Pat. 6,551,025; and in the "Water Filled Membrane Dike," disclosed in Clement, U. S. Pat. 6,641,329.

These systems can be rather complex to use. For example in Clements, U.S. Pat. No. 6,641,329, the ""Water Filled Membrane Dike" involves a complicated system of elongated, inflatable round bladders. At least one of the shortcomings of the above systems is that they are difficult to install and fill quickly. Further, some are incapable of

providing resistance to flood waters unless they are filled with water. In addition they lack the structural strength of rigid structures or containers.

Some systems rely on the use of individual "water bags" or other plastic, flexible water-filled articles of various sizes. These water bags serve essentially as replacements for sandbags. These are exemplified by the "Flood Disaster Control Bag," in Wagner et al., U.S. Pat. No. 4,362,433; the "Water Filled Plastic Dam Structure," in Serota, U.S. Pat. No. 3,213,628; the "Hovering Bag Breakwater," in Weigel et al., U.S. Pat. No. 3,191,386; and in the "Method and Apparatus for Constructing Hydraulic Dams and the Like," in U.S. Pat. No. 5,125,767.

Among the many shortcomings of these "water bag" approaches is that many of them simply do not adequately overcome the time and labor problems presented by sandbags. For example, the water bags or containers in Wagner '433 and Serota '628 must be filled with water before they can provide an effective barrier to flood waters. The plastic container in Serota '628 must be filled with water even before it is positioned, since without water, in its collapsed state, it is essentially formless. Unless these containers are filled with water, they cannot be stacked nor can they even form an effective barrier.

Other systems rely on the use of a plurality of water-filled rigid containers of various shapes and sizes. The structure and materials of composition of these containers enable them to set up easier than the flexible water bag, and membrane tubular type systems These features also enable them to provide greater resistance to the hydrostatic forces of rising water. These are exemplified by the "Portable Highway Barrier" disclosed by in Chiodo, U.S. Patent 4,869,617 and in the "Flood Control System," disclosed in Perry, et. al, U.S. Patent 6,012,872.

Among the many shortcomings of these "water-filled containers" approaches is the time needed to fill them. Another shortcoming of these and the other water filled systems is the need for a pump or other means to fill the containers from the top must be supplied by the user. Another shortcoming is the need for fuel or power to operate the pump. Another shortcoming is the inability of the containers in some of these systems to be disassembled increasing the logistics problem of transporting and depositing an adequate supply of units to build the dam.

Another shortcoming is the weight of the empty containers in some systems requires power-operated equipment to transport and position. In U.S. Patent 6,012,872 Perry, et. al. suggested using large shipping containers e.g., corrugated metal containers that are about 20 feet long, 8.5 feet high and 8 feet wide available from TransAmerica, Inc. and Sea Container, Inc. The weight of these containers requires heavy lifting equipment with skilled operators to deposit them at the desired location. The weight of the containers and the use of the lifting equipment increase the risk of injury and death for those who assist with the deposition of the containers. These factors increase the logistics and cost of using these systems.

Another shortcoming is the complexity of providing an adequate means of stability against tipping over in some of these systems. For example in U.S. Patent 6,012,872

Perry, et. al. suggested using the anchoring members of concrete structures embedded into the surface. The use of this anchoring means limits the locations where the systems can be placed.

Due to changes in land development and rain patterns the flooding patterns will and often do change requiring the flood control system being utilized to be more adaptable and flexible than the present stationary and mobile flood control systems. The need for an improved anchoring means of mobile flood control systems is seen as a means of making mobile water filled flood control systems more reliable, adaptable and flexible. Also a means of utilizing containers that can be transported unassembled, quickly and easily assembled into rigid containers, and the reassembled empty containers can quickly and easily deposited onto and attached to the bases. Also the flood control system will have a means of having the empty containers be self-filling with floodwater. Accordingly, as discussed in greater detail below, the present invention provides a much-improved approach to flood control, overcoming one or more of the above shortcomings of earlier systems.

SUMMARY OF INVENTION

In a broad aspect, the invention is directed to a flood control method and apparatus. In a specific aspect, the method involves: (a) providing a plurality of bases with anchoring members; (b) positioning the plurality of bases at a selected location proximate to a body of water, the bases being positioned at the selected location in an abutting relationship; (c) anchoring the bases to the surface, the base having a metal frame constructed of a pair of parallel metal angle portions, parallel metal strips positioned in between the metal angle, and a second pair of parallel metal angle portions disposed at right angles to first pair of parallel metal angles operably connecting the first pair of parallel metal angles and parallel metal strips; (d) anchoring members deposited through the first pair of parallel metal angles and parallel metal strips; (e) attaching a plurality of containers to the bases, the containers being attached in an abutting relationship; (f) and the bases and containers form a barrier. Preferably, as discussed in greater detail below, the containers are constructed of a bottom panel and the bottom panel is constructed of sections of plastic pipe with metal strips, a pair of parallel end panels and the end panels are constructed of sections of plastic pipe with metal strips, and a pair of parallel sidewalls and the sidewalls are constructed of sections of plastic pipe with a pair of metal frames wherein the sidewalls are operably connecting the bottom panel and pair of end panels.

In a more specific aspect, the flood control method includes the steps of: (a) identifying a flood zone area prior to flooding, the flood zone area being proximate to a body of water, the body of water being susceptible to flooding whereby the top surface of the body of water rises and the water flows into, and onto, the flood zone area; (b) identifying a flood barrier protection area proximate to the flood zone area; (c) providing a substantially level support surface within the flood protection barrier area; (d) providing a plurality of bases; (e) positioning the bases adjacent to one another in an abutting relationship on the substantially level support surface within the flood barrier protection area; (f) inserting anchoring members through the bases and depositing them into the surface: (g) providing

a plurality of containers, the containers having a bottom panel, a pair of parallel end panels and a pair of parallel sidewalls operably connecting the bottom panel and parallel end panels; (g) attaching of the containers in an empty state to the bases with anchoring members adjacent to one another in an abutting relationship to form a barrier to flooding; and (h) attaching at least one of the containers to an adjacent container.

In another aspect of the invention, the flood control method includes the steps of: (a) providing a first base with anchoring members and a skirt, the skirt being substantially impervious to water, and having at least one fixed edge, which is connected to the first base, and at least one free edge, which is unconnected to the first base; (b) placing the first base with anchoring members adjacent to a second base in an abutting relationship proximate to a body of water that is susceptible to flooding by a rising water level, (c) attaching of some of the containers in an empty state to the bases with anchoring members on top of the skirt connected to the bases, (d) attaching of some of the containers in an empty state adjacent to one another in an abutting relationship to form a barrier to flooding, wherein a ground surface is located between the base, the containers and the body of water; and (e) depositing at least a portion of the free edge of the skirt over at least a portion of the ground surface between the body of water and the barrier formed by the first and second bases and attached containers.

Another aspect of the invention relates to a flood control apparatus, which preferably includes: (a) at least two adjacent bases in an abutting relationship: (b) with anchoring members inserted through the bases deposited into the surface (c) at least two adjacent containers in an abutting relationship, each of the at least two containers having a bottom panel, a pair of parallel end panels and a pair of parallel sidewalls operably connecting the bottom panel and parallel end panels, defining a receptacle for receiving water; and (d) a means for preventing floodwater from passing between the bases and containers.

Another aspect of the invention relates to a flood control apparatus, which preferably includes: (a) at least two adjacent bases in an abutting relationship: (b) with anchoring members inserted through the bases deposited into the surface (c) at least two adjacent containers in an abutting relationship, each of the at least two containers having a bottom panel, a pair of parallel end panels and a pair of parallel sidewalls operably connecting the bottom panel and parallel end panels, defining a receptacle for receiving water; and (d) a means for preventing floodwater from passing between the containers.

In still another specific embodiment, the flood control apparatus includes a plurality of rigid containers, each of the containers including at least an outer housing which is constructed of plastic pipe and a pair of metal frames and which is capable of being disassembled, being moved from location to location, being reassembled, being attached to the bases in a selected location, and being attached to a second, adjacent movable outer housing by two or more fasteners, the first outer housing having a bottom panel, a pair of parallel end panels and a pair of parallel sidewalls, the housing also having a pair of parallel sidewalls made of plastic pipe and metal frame and operably connecting the bottom panel and a pair of parallel end panels, wherein the plurality of containers are attached to the anchored bases positioned in a selected location on a substantially

horizontal surface in or proximate to a flood zone area, the containers are attached to anchored bases and being placed end-to-end to form a barrier, and the plurality of containers being attached to anchored bases and being positioned above the water level of the body of water.

In yet another specific embodiment, a flood control apparatus of this invention includes (a) an outer container having a bottom panel, a pair of parallel end panels and a pair of parallel sidewalls operably connecting the bottom panel and parallel end panels; (b) an inner flexible container wherein the flexible container is a bladder constructed of plastic membrane which is disposed inside the outer container, the bladder having an opening for introducing water into the bladder; (c) a pipe inserted through the one of the bottom corners of the front sidewalls of the outer housing; (d) the pipe being sealed between the pipe and juncture with the front sidewall; (e) the opening of the flexible container being attached to the end of the pipe inside the outer container; (f) a detachable one way flow vale being connected to other end of the pipe outside the outer container (g) the one way flow valve allows water to flow into the flexible container; and (h) a second pipe being inserted through of the top corner of the sidewall of the outer housing; (i) the pipe being sealed between the pipe and juncture with the front sidewall; (j) a detachable one way flow vale being connected to end of the pipe outside the outer container (k) the one way flow valve allows air to flow out from the outer housing as the flexible container fills with water.

Another specific embodiment of the apparatus, which is preferred, particularly where the contours of the flooding zone are uneven, or where there are natural obstacles proximate to the body of water such as trees and the like, is a flood control apparatus that includes: (a) at least two bases with anchoring members positioned at right angle (90°) to each other along their edges; (b) attaching at least two containers with outer housings with a bottom panel, a pair of parallel end panels and a pair of parallel sidewalls, operably connecting the bottom panel and a pair of parallel end panels to the bases; (c) a 90° metal angle bracket covered by a sheet of rubber; (d) a 90° metal angle bracket covered by a sheet of rubber operably connecting the bases and containers at the right angle juncture of the edges to the bases and containers; (e) at least two metal bars having 45° bent ends; and (f) at least two metal bars having 45° bent ends operably connecting the other edges of the containers.

The rigid bottom panel may include two or more integral reinforcing metal strips for providing horizontal alignment to bottom panel, the end panels may include two or more integral reinforcing metal strips for providing vertical alignment to the end panels and the sidewalls may include one or more integral reinforcing metal strips for providing vertical alignment to the sidewalls.

A specific embodiment of this invention, which is preferred, is to provide a container that is (a) easily disassembled for storage and easy transport; (b) easily and quickly assemble into a sturdy, reliable and reusable container; (c) includes an outer housing constructed of plastic pipe, metal strips and metal frames; (d) the container being capable of being moved from location to location, of being attached to a base anchored to the surface by

two or more fasteners in a selected location, and of being attached to a second, adjacent outer housing by two or more fasteners.

The flood control method also includes the step of the containers self-filling with water as the level of the floodwater rises to provide sufficient weight to the containers to enhance the anchoring means of the bases to resist the hydrostatic forces of rising water.

Further, the flood control method should include the step of attaching a flexible container to the rigid containers, then allowing the flood water to fill the inside of the flexible container as the flood water rises outside the rigid container. These flexible containers should be expandable bladders made of a material such as plastic, with an opening to receive water. In using the flexible container with the flood control method, the water can be removed from the flexible container by detaching the one way flow valves from both the water inlet pipe attached to the flexible container and the air vent pipe, e.g., after flooding situation has abated and prior to disassembling and removing the containers from a flood barrier protection area.

The flood control method also includes the step of connecting one or more of the plurality of rigid containers to other containers. Further, where at least two of the rigid containers are adjacent to one another, a rubber gasket is sealed to the outer edges of the metal frames of the sidewalls and bases. The bases and the metal frames are tightened together by the fasteners to form a liquid tight seal. The use of foam and plastic sheeting as suggested by Perry, et. al. produces a less durable seal and can be damaged or deformed preventing the seal from occurring. The damaged foam and plastic sheeting become waste that must be disposed of and replaced increasing the cost of use of the flood control system. If the foam or plastic sheeting supplies run out the integrity of the system is compromised.

The flood control method also includes the step depositing the bases in an abutting relationship upon the surface. The flood control method also includes anchoring members being inserted through the bases and being deposited into the surface creating a foundation that hold the bases in a fixed stable position. The flood control method also includes the foundation being embedded into the surface. The flood control method also includes attaching the rigid containers to the anchored bases. In addition, the method includes the step of stacking containers on top of other containers attached to the bases.

Further, wherein a skirt is connected to the base, and an air space is formed between the first and second bases it is preferred that at least a portion of the free edge of the skirt covers the air space. In addition, where a skirt is used, it is preferred that at least a portion of the skirt attached to one base overlaps at least a portion of another base.

Where a skirt is used as part of the flood control method, at least a portion of the free edge of the skirt will be held down by a pair of parallel rows of pipe held down by sand and water filled containers deposited on top of the row plastic pipes. The pipe and container system being lighter and quicker to install than metal bars as suggested by Perry et. Al.

Brief Description of Several Viewing Of Drawings

Figure 1 Side View Of Double Stacked Units

Figure 2 Front View Of Double Stacked Multiple Units

Figure 3 Three Dimensional View of Unit

Figure 4 Side View Of Anchored Double Stacked Units

Figure 5 Front View Of Anchored Double Stacked Multiple Units

Figure 6 Three Dimensional View of Anchored Unit

Figure 7 Overhead View Of Base

Figure 8 Front View Of Base

Figure 9 Cross Sectional Front View Of Base

Figure 10 Cross Sectional Side View Of Base

Figure 11 Front View Of Front Side Wall

Figure 12 Rear View of Front Sidewall

Figure 13 Outside View of Back Sidewall

Figure 14 Inside View of Back Sidewall

Figure 15 Side View of Front Sidewall

Figure 16 Side View of End Panel

Figure 17 Side View of Rear Sidewall

Figure 18 Erected Cross Sectional View Of End Panels And Bottom Panel

Figure 19 Cross Sectional View Of End Panels And Bottom Panel Folded Into Shipping and Storage Position

Figure 20 Cross Sectional View Of Bottom Panel And Top View of End Panels Packed For Shipping and Storage

Figure 21 Unfolded Cross Sectional View Of End Panels And Bottom Panel

Figure 22 Overhead View Of Unfolded End Panels And Bottom Panel

Figure 23 Bottom View Of Unfolded End Panels And Bottom Panel

Figure 24 Cross Sectional Side View Of Anchored Double Stacked Units With Empty Bladders

Figure 25 Cross Sectional View Of Anchored Double Stacked Units Water Filled Bladders

Figure 23 Overhead View of Empty Anchored Joined Units With Skirt

Figure 24 Overhead View of Anchored Joined Units With Water Filled Bladders With Skirt Attachment

Figure 25 Overhead View of Enclosed Area Protected By Installed Emergency Flood Control System

Figure 26 Overhead View Of Empty Joined Units With Skirt

Figure 27 Flood Control Channel

Figure 28 Protected Enclosed Area

Figure 29 Overhead View of Joined Units At 90° Angle

Figure 30 Front View Anchored Flood Control System Joined At Right Angle

Figure 31 Overhead View Of An Overhead Storage Tank

Description

DETAILED DESCRIPTION AND SPECIFIC EMBODIMENTS

As mentioned above, the invention is preferably directed to flood control systems. Both methods and apparatus for flood control are within the scope of the invention. We will now describe specific embodiments, examples and versions of the invention, for the purpose of enabling others skilled in the art to make and use our invention. It is understood, however, that the invention is not limited to these specific embodiments, examples and versions. Nor is the invention restricted to flood control as such, but may be used in other applications involving the forming of a barrier to prevent or restrict the flow of any liquid. Another use may be for crowd control or as a road barrier.

A person skilled in the art that has read this patent or seen the invention being used, described, or implemented will recognize many variations of the invention that might not be expressed here. Thus, it is the claims below that should be referred to for purposes of determining the scope of the invention, not only the literal elements therein, but also their substantial equivalents, including elements known to be interchangeable.

FIG. 1 is a side view of the flood control system **24** deposited onto the surface **20**. The flood control system consists a bottom container **38b** with a rubber gasket **32** sealed along the edges of the sidewalls deposited onto the surface **20**. Also show is a second container **38a** with a rubber gasket **32** sealed along the edges of the sidewalls deposited on top of the first container **38b**. As shown the second container **38a** is attached to the first container **38b** by two or more fasteners that can not be seen in this perspective. The two containers are deposited in an abutting relationship and attached to together to form a flood control barrier **24**.

FIG. 2 is a front view of the flood control system. In the particular embodiment shown in the barrier **24** is composed of four containers **38a, 38b, 38c**, and **38d**. (These will be referred to collectively as containers using the reference number **38** respectively.) As shown the top row of containers **38a** and **38c** are stacked on top of the bottom row of containers **38b** and **38d**. The bottom row of containers **38b** and **38d** are deposited on the surface **20**. As will also be discussed the containers **38** are lightweight being constructed of plastic pipe, metal strips and metal frames to facilitate easy of transporting and stacking while reducing costs of transporting and handling the flood control system and risks of worker injury.

FIG. # 3 is a three dimensional view of a container **38** deposited on a surface **20**.

FIG. 4 is a side view of the flood control system anchored to the surface **20**. The flood control system consists a base **26** anchored to the surface **20** by anchoring members **28** a and a bottom container **38b** with a rubber gasket **32** deposited on the bottom edges the sidewalls attached to the base **26**. As shown the bottom container **38b** is attached to the base **26** by two or more fasteners that cannot be seen in this perspective. Also show is a second container **38a** deposited on top of the first container **38b**. As shown the second container **38a** is attached to the first container **38b** by two or more fasteners that can not be seen in this perspective. The anchored base, and two containers are deposited in an abutting relationship and attached to together to form a flood control barrier **30**.

As shown the anchoring members **28** are deposited into the surface at a given angle "A" to given depth "D" and width "W". As will be discussed later depositing the anchoring members to given width "W", given depth "D", and given length "L" produces a stable foundation **22** embedded into the surface having a given weight W_F the flood control system. The embedded foundation **22** produces a very stable means of preventing the flood control barrier **30** from being moved or tilted by the rising floodwater. This embedded foundation **22** also produces a very stable means of preventing the flood control barrier **30** from being moved or tilted by the flowing floodwater.

FIG. 5 is a front view of the flood control system. In the particular embodiment shown in the barrier **30** is composed of two bases **26a** and **26b** and anchoring members **28** and four containers **38a, 38b, 38c**, and **38d**. (These will be referred to collectively as bases and containers using the reference numbers **26** and **38** respectively.) As shown the top row of containers **38a** and **38c** are stacked on top of the bottom row of containers **38b** and **38d**. The bottom row of containers **38b** and **38d** are stacked on top of the bases **26a** and **26b**. The anchoring members **28** anchor the bases **26** into the surface **20**. As shown the anchoring members **28** are deposited into the surface **20** to a given depth "D" for a given length "L". As shown in FIG. 4, the anchoring members **28** are deposited into the surface **20** at a given angle A to given depth "D" for a given width "W".

As will be discussed later depositing the anchoring members **28** to a given width "W", a given depth "D", and a given length "L" produces a temporarily fixed but very strong and stable foundation **22** having a predetermined size and weight W_F for the flood control system. The foundation **22** is embedded into the surface **20**. As will also be discussed the containers **38** are lightweight being constructed of plastic pipe, metal strips and metal frames to facilitate easy of transporting and stacking while reducing costs of transporting and handling the flood control system and risks of worker injury.

FIG. # 6 is a three dimensional view of an anchored base **26** and attached container **38**. The anchoring members **28** anchor the base **26** to the surface **20**. The anchoring members **28** are metal rods, spikes or pipes of a predetermined length, size and shape. The shapes can be circular, oval, square, triangle, hollow, solid, hooked, etc. The anchoring members **28** are deposited into the surface **20** at a predetermined angle Y. The deposition of the anchoring members **28** to a given width "W", given depth "D", and given length "L" creates a foundation **22** that is embedded into the surface **20**. The size or volume of the foundation **22** can be calculated (W x D x L) in cu. ft. Multiplying the size (cu. ft.) of the foundation **22** by the weight of a cu. ft. of water times the density of the surface 20 the weight W_F of the foundation can be calculated.

For example, given the width of the foundation **22** is 2 ft, the depth is 1.5 ft, and the length is 500 ft the size of the foundation is1500 cu. ft. The weight of a cu. ft of water is approximately 63.73 pounds per cu. ft. and if the density of the surface 20 is 1.1 then the weight W_F of the foundation is equal to 1500 cu. ft. X 63.73 pounds per cu. ft. X 1.1 or 105,154.5 pounds or 52.6 tons.

This calculation shows that a 500-foot long flood control barrier **30** constructed of anchored bases **26** and rows of empty containers **38** is being held in position by a 52.6 ton foundation **22** that is embedded into the surface **20**. As will be shown the weight of the flood control barrier **30** will increase as the containers 38 become filled due to the rising floodwater. As the weight of the flood control barrier **30** increases the resistance to the hydrostatic forces of the rising floodwater increases.

Figure 6 depicts the width and length of the foundation **22** being wider and longer than the base **26** because the angular deposition of the anchoring members **28**. The wider and longer foundation **22** embedded into the surface **20** produces a more stable flood control system than any of the existing mobile systems. The temporarily fixed foundation **22**

embedded into the surface **20** and the weight of the water filled containers **38** are a very unique means of providing resistance to the hydrostatics forces of rising floodwater for this flood control barrier system **30**.

Referring now to Fig. 7, an overhead view of the base **26** for anchoring the flood control barrier **30** is shown. The particular embodiment shown in FIG. 7 is a rectangular shape base **26** composed of a pair of parallel 90° metal angle portions **26a** and two or more metal strips **26b** deposited in between the metal portions **26a**. The ends of the metal strips **26b** are attached at right angle to the pair of parallel 90° metal angle portions **26a**. At the ends of the pair of parallel 90° metal angle portions **26a** the ends of a second pair of parallel 90° metal angle portions **26c** are attached at right angle. A predetermined number of holes **26d** of a predetermined size are cut into the metal strips **26b** and the pair of parallel 90° metal angle portions **26c**. Screws **26e** for attaching another base **26** to the first base **26** are inserted through the 90° metal angle portions 26a. A rubber gasket 26g is sealed to outer surface of the 90° metal angle portions 26a to create a watertight seal when the bases 26 are attached to one another. A third pair of parallel 90° metal angle portions 26f are attached to the second pair of parallel 90° metal angle portions 26c to provide the means for attaching the containers 38 to the bases 26 by two or more screws.

In FIG. 8 the front view of the base **26** is shown. In the particular embodiment shown a 90° metal angle portions **26g** is attached in front of the 90° metal angle portions **26c**. Two or more screws **26h** are inserted through the 90° metal angle portions **26g**. Also shown are the screws **26e** for attaching another base **26** to the first base **26**. The rubber gasket **26 f** that is sealed to the outer surface of metal angle portion **26a** is also shown.

FIG 9 is a cross sectional front view of the base **26** including anchoring members **28** along the A to A axis shown in FIG. 7. The figure shows the anchoring members **28** deposited into the surface **20** to a predetermined depth "D" through the metal strip **26 b**. The figure shows the plurality of rows of anchoring members **28** that anchor the base **26** to the surface **20**.

FIG 10 is a cross sectional side view of the base **26** including anchoring members **28** along the B-to-B axis shown in FIG. 7. The anchoring members 28 are deposited into the surface **20** at a predetermined angle Ɣ producing a crisscrossing pattern. The crisscrossing pattern enhances the holding and grabbing effect of the anchoring members **28** in the surface **20** similar to the roots of a tree. Also shown is the skirt attached to the base **26**.

FIG. 11 is a front view of the front sidewall **40** of the outer container **38**. The front sidewall **40** is composed of sections of plastic pipe **42**. PVC is the preferred material. It is a commonly used material that is readily available. Also it has great structural strength, is lightweight, and sturdy. The pipes are sealed together with a strong watertight sealant. A metal frame **44** constructed of 90° metal angle portions **46** that are attached to the outer surface of the sidewall along the edges of the plastic pipes **42**. Holes **48** are cut into the sidewall at selected locations through which threaded rods **50** will be inserted. A plastic pipe **52** of a predetermined size through which water enters the container **38** is inserted through and sealed to the sidewall **40** at the bottom corner. A

plastic pipe **54** of a predetermined size through which air exits the container is inserted through and sealed to the sidewall **40** at the upper corner opposite the water inlet pipe **52**.

FIG. 12 is a view of the inner surface of the front sidewall **40** of the outer container **38**. Strips of rubber gasket material **56** are sealed along the edges of the sections of the pipe **42**. Shown are the holes **48** cut into the sidewall at selected locations through threaded rods **50** will be inserted. Also shown is water inlet pipe **52** through which water enters the container **38** at the bottom corner. Also shown is the air outlet pipe **54** through which air exits the container at the upper corner opposite the water inlet pipe **52**.

FIG. 13 is a view of the outer surface of the back sidewall **58** of the outer container **38**. The back sidewall **58** is composed of sections of plastic pipe **42**. The pipes are sealed together with a strong watertight sealant. A metal frame **44** constructed of 90° metal angle portions **46** is attached to the outer surface of the sidewall along the edges of the plastic pipes **42**. Holes **48** are cut into the sidewall at selected locations through which threaded rods **50** will be inserted.

FIG. 14 is a view of the inner surface of the back sidewall **58** of the outer container **38**. Strips of rubber gasket material **56** are sealed along the edges of the sections of the pipe **42**. Shown are the holes **48** cut into the sidewall at selected locations through threaded rods **50** will be inserted

FIG. 15 is a side view of the front sidewall component **40** of the outer container **38**. The front sidewall component **40** is composed of sections of plastic pipe **42** shown in vertical alignment. Strips of rubber gasket material **52** are sealed along the edges of the sections of the pipe **42**. A metal frame **44** constructed of 90° metal angle portions **46** is attached to the outer surface of the sidewall along the edges of the plastic pipes **42**. Holes **60** are cut into the frame **44** at selected locations through which screws **62** will be inserted. Also shown are the water inlet pipe **52** and air vent pipe **54**. Also shown are the washers **64** and nuts **66** that provide the means by which the rods **50** connect the sidewalls **40** and **58**.

FIG. 16 is a view of the outer surface of one of the end panels **68**. Two or more metal strips **70** are sealed to the sections of pipe **42** to keep them aligned. Nylon straps **72** are attached to the metal strips **70** and sections of pipe **42**. FIG. 16 also shows the threaded rods **50** inserted through the sections of pipe **42** at predetermined locations.

FIG. 17 is a side view of the back sidewall component **58** of the outer container **38**. The back sidewall component **58** is composed of sections of plastic pipe **42** in vertical alignment. Strips of rubber gasket material **52** are sealed along the edges of the sections of the pipe **42**. A metal frame **44** constructed of 90° metal angle portions **46** is attached to the outer surface of the sidewall along the edges of the plastic pipes **42**. Holes **60** are cut into the frame **44** at selected locations through which screws **62** will be inserted. Also shown are the washers **64** and nuts **66** that provide the means by which the rods **50** connect the sidewalls **40** and **58**.

FIGS. 18 is a cross sectional view of the pair of end panels **68** and bottom panel **74** of the outer container **38**. The bottom panel **74** lays horizontal and the end panels **68** are raised into a vertical position.

FIG. 19 is a cross sectional view of the pair of end panels **68** and bottom panel **74** folded into a position for shipping and storage.

FIG. 20 is another view of the pair of end panels **68** and bottom panel **74** folded into a position for shipping and storage

FIG. 21 is a cross sectional view of the pair of end panels **68** and bottom panel **74** lying in a horizontal position.

FIG. 22 is an overhead view of the inner surface of the pair of end panels **68** and bottom panel **74** lying in a horizontal position. The figure shows the bottom panel **74** and the end panels **68** are attached together by straps **72**. Strips of rubber **76** are sealed to the inner surface on the end sections of pipe of the bottom panel **74**.

FIG. 23 is an overhead view of the outer surface of the pair of end panels **68** and bottom panel **74** lying in the horizontal position. The figure shows the pair of end panels **68** and bottom panel **74** have metal strips **70** sealed to them and are attached together by straps **72**.

FIG. 24 is a cross sectional side view of the flood control barrier **30** composed of a base **26** anchored to the surface **20** by anchoring members **28** having outer containers **38** with empty inner containers **78** attached to the water inlet pipes **52**. The empty inner containers **78** are flexible bladders **78** constructed of plastic. Detachable one-way flow control valves **80** are also shown attached to the water inlet pipes **52**. The air vent pipes **54** through which the air exits the outer container **38** are also shown in this figure. Detachable one-way flow control valves **80** are also shown attached to the air vent pipes **54**. The attached edge **82a** of the skirt **82** attached to the base **26** in between the base **26** and outer container **38** is also shown. The pair of parallel pipes **84a** and **84b** is shown deposited at the outer edge of the skirt **82**. Another section of pipe **84c** connecting the pair of pipes **84a** and **84b** together is shown. A hold down container **86** for the pipes **84a** and **84b** is also shown. Sand **88** deposited in the bottom of the container **86** is also shown.

FIG. 25 is a cross sectional side view of the flood control barrier **30** composed of a base **26** anchored to the surface **20** by anchoring members **28** having outer containers **38** with the inner flexible bladders **78** that have been filled with floodwater **90**. Also shown is the self filling process. The X arrow shows the flow of the floodwater into the flexible inner container **78.** The pressure $\mathbb{P}_O$ of the floodwater outside the outer containers **38** is greater than the air pressure $\mathbb{P}_A$ within the containers **38** and forces the flow X of floodwater through the water inlet pipe **52** and detachable one-way flow control valve **80** into inner flexible bladder **78**. The Y arrow shows the air in the container **38** being released through the air vent pipes **54** and detachable one-way flow control valves **80** to the

atmosphere out side the containers **38** as the inner flexible bladder **78** fill with floodwater.

As shown by the $\mathbb{Z}$ arrows as the inner bladders **78** fill with the floodwater the pressure inside $\mathbb{P}_I$ and outside $\mathbb{P}_O$ the containers equalize.

The water filled containers **38** provide weight in addition to the weight $\mathbb{W}_F$ of the foundation **22** to resist the hydrostatic forces of the rising floodwater. As shown previously the weight of structure of a given size can be easily calculated. In the figure shown if the height $\mathbb{H}_1$ of the water in the bottom containers is 3 feet and the width is 1.5 ft and the length is 500 ft. the weight $\mathbb{W}_1$ will be 143,392.5 lbs or 71.7 tons. If the height $\mathbb{H}_2$ of the water in the top containers is 2 feet and the width is 1.5 ft and the length is 500 ft. the weight $\mathbb{W}_2$ will be 95,595 lbs or 47.8 tons.

When the weight $\mathbb{W}_F$ of the foundation (105,154.5 pounds or 52.6 tons), the weight $\mathbb{W}_1$ of the bottom containers (143,392.5 lbs or 71.7 tons) and the weight $\mathbb{W}_2$ of the top containers (95,595 lbs or 47.8 tons) are added together the total or cumulative weight $\mathbb{W}_C$ holding back the hydrostatic forces of a 5 feet high 500 feet long floodwater is 344,142 lbs. or 172 tons. The weight will be greater when the weight of the empty containers is added to the above cumulative weight.

Also shown in the figure the attached edge **82b** of the skirt **82** is attached to the base **26** and is deposited between the base **26** and the bottom edge of the front sidewall **40** of the container **38**. The pipes **84a, 84b** and **84c** are deposited along the outer edge of the skirt **82** distal from the base **26**. A self-filling container **86** is deposited on top of the pipes **84a** and **84b**. The self-filling container **86** is partially filled with sand **88**. The skirt **82** is deposited over the surface **20** preventing the surface **20** in close proximity around to flood control barrier **30** from being saturated with water causing a loosing of the soil.

FIG. 26 is an overhead view of the flood control barrier **30** showing the containers **38** with the skirts **78**, pipes **84a, 84b** and **84c** and containers **86** deposited in place. As shown the pipes **84a, 84b** and **84c**, and containers **86** are deposited along the unattached outer edges of the skirts **78** distal to the flood control barrier **30** to hold down the skirts **78** as the floodwater rises. An outline (shown by the dotted lines) of the surface area (W x L) of the foundation **22** is also shown. The surface area of the flood control barrier **30** shows the stability that the foundation **22** provides the flood control barrier **30**.

FIG. 27 is an overhead view of the flood control barrier **30** showing the bases **26** and containers **38** deposited in an arrangement to form a flood control channel.

FIG. 28 is an overhead view of the flood control barrier **30** showing the bases **26** and containers **38** deposited in an arrangement to form an enclosure that protects a given area.

FIG. 29 is an overhead view of a 90° metal angle bracket **92** connecting two containers **38** positioned at right angle to one another. A first metal bracket **94** with 45° angle bend at each end is also shown connecting the two containers **38** on the same side near the top at the edges of the two containers **38**. A second metal bracket **94** with 45° angle bend at

each end is also shown connecting the two containers **38** on the same side near the top at the edges of the two containers **38**.

FIG. 30 is a front view of a top metal bracket **94a** with a 45° angle bend at each end connecting two containers **38a** and **38c** positioned at right angle to one another. A bottom metal bracket **94b** with a 45° angle bend at each end connecting the two containers **38b** and **38d** positioned at right angle to one another is also shown.

FIG. 31 is an overhead view of flood control barrier **30** showing the bases **26** and containers **38** deposited in an arrangement to form an enclosure that contain liquids within. The flood control barrier **30** has a liner **96** deposited inside the enclosure that enables the flood control barrier **30** to be transformed into an above ground storage tank. The liner **96** being imperious to liquids is attached to the edge of the bases **26** similar to the attachment of the skirts **82**.